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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/767,281
Filing Date: January 30, 2004
Appellant(s): KIM ET AL.

Robert E. Bushnell
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed February 8, 2008 appealing from the Office action mailed March 9, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,271,543 B1	Ohtani et al.	08-2001
5,278,099	Maeda	01-1994
20003/0222575 A1	Yamazaki et al.	12-2003

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 4-7, 9, 14, 15, and 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohtani et al. (US 6,271,543 B1) in view of Maeda (US 5,278,099).

In re claims 1 and 14, Ohtani shows (figs. 2A-3A and col. 6, line 38 – col. 7, line 22) a thin film transistor (208), comprising a source electrode (206), a drain electrode (207), a gate electrode (202) and a semiconductor layer (201), wherein one of the

source electrode and the drain electrode comprises an aluminum layer disposed between a pair of titanium layers (col. 7, lines 10-13). Ohtani shows all of the elements of the claims except the aluminum layer being an aluminum alloy and a diffusion prevention layer interposed between the aluminum alloy layer and each of the pair of titanium layers. Maeda shows (fig. 1F) a source/drain electrode having a titanium layer (32), an aluminum alloy layer (36) (col. 4, lines 22-31), and a titanium nitride layer (34) interposed between the Ti and Al alloy to act as a barrier for blocking Al diffusion and preventing the growth of alloy spikes (col. 3, lines 46-61). The aluminum layer may be alloyed with Si to reduce the resistance and prevent openings in the wiring (col. 4, lines 22-31). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Ti/Al/Ti source/drain electrode of Ohtani by alloying Si with aluminum and forming TiN between the Ti and Al alloy layers as taught by Maeda to reduce resistance of the contact and prevent Al diffusion and the growth of alloy spikes.

In re claims 2 and 15, Maeda discloses (col. 4, lines 22-31) that the aluminum alloy layer comprises an element selected from a group consisting of silicon, copper, neodymium, platinum and nickel. Maeda does not disclose the specific weight percentage of the element in the alloy. However, It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the aluminum alloy having the desired percentage of an element, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In re claim 4 , Maeda discloses (col. 3, lines 46-61) each diffusion prevention layer is made of titanium nitride.

In re claims 5 and 6, the references do not teach the thickness of the titanium nitride or the percentage of nitrogen in the TiN being within the desired range. However, it would have been obvious to one of ordinary skill in the art to make the thickness of the TiN layer or the percentage of nitrogen within the desired range, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller, 105 USPQ 233.*

In re claims 7 and 19, Maeda discloses (col. 4, lines 22-31) that the Al electrode is an alloy containing Si and is therefore absent of pure aluminum.

In re claims 17 and 18, a "product by process" claim limitation is directed to the product per se, no matter how actually made, In re Hirao, **190 USPQ 15 at 17**(footnote 3). See also in re Brown, **173 USPQ 685**: In re Luck, **177 USPQ 523**; In re Fessmann, **180 USPQ 324**: In re Avery, **186 USPQ 116** in re Wertheim, **191 USPQ 90** (**209 USPQ 254** does not deal with this issue); and In re Marosi et al, **218 USPQ 289** final product per se which must be determined in a "product by, all of" claim, and not the patentability of the process, and that an old or obvious product, whether claimed in "product by process" claims or not. Note that Applicant has the burden of proof in such cases, as the above case law makes clear. "Even though product-by- process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the

product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

In re the remaining limitations of claim 18 concerning the conductive channel formed between the source and drain electrodes, Ohtani discloses (col. 6, lines 63-67) that a channel is formed between the source and drain of the device. The semiconductor is also primarily made of silicon (col. 6, lines 51-58) and contains the conductive channel.

Claims 8-13 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohtani et al. (US 6,271,543 B1) in view of Maeda (US 5,278,099) and Yamazaki et al. (US Pub. 2003/0222575 A1).

In re claims 8 and 21, Ohtani shows (figs. 2A-3A) a flat panel display and a process for making a flat panel display(col. 6, line 38 – col. 7, line 26) comprising forming: a substrate; a first plurality of thin film transistors formed on a surface of the substrate (there is a plurality of TFT's because the invention pertains to an active matrix array-which is known to contain many devices), the first plurality of thin film transistors comprising first source electrodes (connected 206), first drain electrodes (207), first gate electrodes (connected 202), and semiconductor layers (201); a plurality of first conductive lines (source wiring lines) electrically connected to the first source electrodes; and a plurality of second conductive lines (gate wiring lines) electrically connected to the first gate electrodes. Although Ohtani does not show the complete

active matrix having a second plurality of thin film transistors, wherein the first drain electrodes of the first plurality of thin film transistors are electrically connected to gate electrodes of the second plurality of thin film transistors, such a recitation is of a well known routing scheme. For instance Yamazaki et al. discloses [0175] a complete device having the gate electrode of one TFT connected to a drain electrode of another TFT for a driving circuit. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the routing scheme of Ohtani by adding a plurality of TFTs and connecting them as taught by Yamazaki to form a complete device having a driving circuit.

Furthermore, Ohtani discloses (col. 7, lines 10-13) that one of the first source electrodes, the first drain electrodes, the plurality of first conductive lines, and the plurality of second conductive lines comprises an aluminum layer disposed between a pair of titanium layers Ohtani shows all of the elements of the claims except the alloy layer being an aluminum alloy and a diffusion prevention layer interposed between the aluminum alloy layer and each of the pair of titanium layers. Maeda shows (fig. 1F) a source/drain electrode having a titanium layer (32), an aluminum alloy layer (36) (col. 4, lines 22-31), and a titanium nitride layer (34) interposed between the Ti and Al alloy to act as a barrier for blocking Al diffusion and preventing the growth of alloy spikes (col. 3, lines 46-61). The aluminum layer may be alloyed with Si to reduce the resistance and prevent openings in the wiring (col. 4, lines 22-31). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Ti/Al/Ti source/drain electrode of Ohtani by alloying Si with aluminum and forming

TiN between the Ti and Al alloy layers as taught by Maeda to reduce resistance of the contact and prevent Al diffusion and the growth of alloy spikes.

In re claims 9 and 22, Maeda discloses (col. 4, lines 22-31) that the aluminum alloy layer comprises an element selected from a group consisting of silicon, copper, neodymium, platinum and nickel. Maeda does not disclose the specific weight percentage of the element in the alloy. However, It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the aluminum alloy having the desired percentage of an element, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In re claims 11 and 23, Maeda discloses (col. 3, lines 46-61) each diffusion prevention layer is made of titanium nitride.

In re claims 12, 13, and 24, the references do not teach the thickness of the titanium nitride or the percentage of nitrogen in the TiN being within the desired range. However, it would have been obvious to one of ordinary skill in the art to make the thickness of the TiN layer or the percentage of nitrogen within the desired range, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller, 105 USPQ 233.*

(10) Response to Argument

The appellant first argues that Ohtani teaches away from a three layer laminated structure of titanium/aluminum alloy/titanium since Ohtani does not teach using the aluminum alloy for the source wiring line and drain electrode. The appellant further asserts that Ohtani previously contemplated using an aluminum alloy for the gate wiring line and such a teaching is further evidence that Ohtani only considered pure aluminum for the source wiring line and drain electrode. Ohtani does not specifically teach that pure aluminum can only be used for the source line and drain electrode. The appellant is referring to the disclosure of Ohtani in column 7, lines 10-13 which only states that "as the source wiring line 206 and the drain electrode 207, a three-layer laminated structure of titanium/aluminum/titanium is used." Such a statement does not "teach away" from using an aluminum alloy. Ohtani is only disclosing the basic design of the source and drain without getting into too much detail about these components. If it were truly critical to the invention, Ohtani would have specifically stated that an aluminum alloy cannot be used for the source line and drain electrode. Ohtani does not make any statements of that nature in the disclosure.

The appellant further argues that the wiring layer of Maeda may not need an aluminum alloy (such as Si) since TiN prevents the growth of alloy spikes. Although Maeda indicates in column 3, lines 62-64 that the layer (36) can be pure aluminum, Maeda also indicates in column 4, lines 22-31 that the pure aluminum layer (36) may be replaced by an aluminum alloy (such as Al-Si). Maeda further discloses an example (col. 4, lines 48-52) in which Al-Si alloy layer is used with the TiN layer. Maeda further

indicates (col. 4, lines 27-31) that when Si is used in the alloy, the resistance of the alloy layer is kept low and openings in the wiring are prevented. From the teachings of Maeda, it is found that one may choose to form an Al alloy layer or not form and Al alloy layer in conjunction with the Ti and TiN layers of the wiring electrode. Maeda recites specific teachings and benefits for using the TiN layer and the Al alloy layer and therefore cures the deficiencies of Ohtani.

As stated previously, the examiner agrees that Ohtani does not specifically disclose the aluminum alloy for the source and drain electrodes, however Maeda cures the deficiencies of Ohtani by teaching an aluminum alloy layer for an electrode. Even though one may not make the assumption that the source and drain electrodes of Ohtani are not made of the same aluminum alloy layer as the gate electrode, Maeda still properly cures the deficiencies of Ohtani by teaching an aluminum alloy layer for an electrode. Maeda provides proper motivation for using the aluminum alloy or the TiN barrier layer and therefore, the 35 USC 103 Rejection above is proper.

The appellant further agues that the rejections pertaining to the specific weight percentage in the alloy, the thickness of the titanium nitride layer, or the percentage of nitrogen in the desired range are not supported with secondary references. The examiner has relied upon the known case law for teachings of obviousness. One of ordinary skill in the art would be motivated to modify the weight percentage of Si in the aluminum alloy to provide a lower, desired resistance of the electrode since Maeda already teaches (col. 4, lines 27-31) that when Si is added to the aluminum alloy, the resistance is kept low. One of ordinary skill in the art would be motivated to modify the

titanium nitride layer having a specific desired thickness or percentage of nitrogen to provide a barrier layer that is suitable for blocking Al diffusion and preventing alloy spikes since Maeda teaches (col. 3, lines 47-68) that the TiN already has a sufficient thickness to prevent the growth of alloy spikes. The appellant has not provided reasons why the limitations in question (alloy weight percentage, TiN thickness, nitrogen percentage) cannot be modified and patentably distinguishable over the cited references. The appellant has also not provided reasons why the limitations in question are critical to the invention. For these reasons, the limitations in question are deemed to be mere obvious modifications of the cited references.

In re the arguments to the rejection of claim 18, the limitations in question pertain to the formation of the device and viewed as "product by process" limitations. The limitation of the semiconductor layer forming a conductive channel between the source electrode and drain electrode upon the application of a voltage to the gate electrode is also viewed as "product by process" limitation since the limitations pertain to how the channel is formed. In addition, these limitations recite how the device is to be used or operated and are not germane to the structure. Furthermore, these limitations merely recite the typical and well known operation of a semiconductor device. Even if such were not the case, the structure recited in the claims has a source and drain electrode and a semiconductor layer between them. Since the structure and materials are the same as the appellant's claimed invention, the device of the cited references would operate in the same manner. Even still, the appellant has not provide reasons why the limitations of claim 18 are patentably distinguishable over the prior art.

In re the arguments over the 35 USC 103 Rejection of claims 8 and 21, the appellant states that the inclusion of Yamazaki is improper but does not give reasons why the rejection is improper. Therefore, it is not understood what the appellant is arguing. As stated in the rejection of claims 8 and 21 above, Yamazaki was cited to cure the deficiencies of Ohtani by disclosing the well known routing scheme recited in the claims. Yamazaki cures the deficiencies of Ohtani by disclosing the recited routing limitations which are useful for operation of an electronic device. The combined references show all of the limitations of the claims and the rejection is still proper.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Matthew E Warren/

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